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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/437,006	11/09/1999	TAMMY ZHENG	PHA 51219	7398

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EXAMINER

CHEN, KIN CHAN

ART UNIT PAPER NUMBER

1765

DATE MAILED: 01/08/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/437,006

Applicant(s)

ZHENG ET AL.

Examiner

Kin-Chan Chen

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 November 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 and 3-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 3-18 and 21 is/are rejected.
- 7) ☒ Claim(s) 19 and 20 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet.
- 37 CFR 1.78.
- a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on October 28, 2003 has been entered.

Claim Rejections - 35 USC § 112

2. Claims 1, 3-18 and 21 are rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. The first and second etching chemistries are critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). Claims do not set forth first and second etching chemistries involved in the method/process, which is critical to produce unexpected results that minimize notching in pillar structure without affecting selectivity in the plasma etching process. Therefore, Claims do not reasonably provide enablement for one skilled in the art to perform special function and effect.

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1, 3-18, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grimbergen et al. (US 6,081,334; hereinafter "Grimbergen ") in view of Witek et al. (US 5,627,395; hereinafter "Witek ").

In a process of forming a semiconductor device, Grimbergen teaches that a least one device layer (e.g., polysilicon) and an anti-reflective coating may be formed over a wafer surface. A hard mask may be provided over a portion of the device (col. 5, lines 51-67, Figs. 1a and 1b). A plasma-etch may be applied using first and second etching chemistries and selectively etching into the device layer to form a pillar structure (such as gate electrode) having at least one sidewall. The first chemistry may include HBr , Cl_2 , He-O_2 . After using the first chemistry, a plasma-etch using a second chemistry may be performed. The halogen content of the etchant gas may be reduced to obtain slower and more controllable etch rates (col. 18, lines 15-30) in order to stop the etching process without etching through the silicon dioxide underlayer on the substrate (col. 18, lines 15-17).

Unlike the claimed invention, Grimbergen does not teach using nitrogen, rather, Grimbergen teaches using Helium (He) in the second etching chemistry. Grimbergen teaches, after using the first chemistry, using a plasma-etch of a second chemistry that the halogen content of the etchant gas may be reduced to obtain slower and more

controllable etch rates in order to stop the etching process without etching through the silicon dioxide underlayer on the substrate. In a method of polysilicon etching, Witek teaches that HBr and Cl_2 are generally used and the inert gas such as Ar, He, or nitrogen may be used. It would have been obvious to one with ordinary skill in the art to use nitrogen of Witek in the Grimbergen process because Witek teaches the equivalence between using He and nitrogen in the processes that are similar to those as taught by Grimbergen wherein polysilicon is etched. The substitution of one for the other would have been expected to provide the same function and effect of a non-reactive (inert) gas in the etching process (such as minimize notching without affecting selectivity) and help provide slower etch rates in the second-stage etching. Furthermore, it is notoriously well known that in the dry etching process, the inert gas is used for diluting the etchant and changes the etching rate (also see Wang et al. (US 6,232,184) in the record as evidence).

The limitations of dependent claims 4, 9-11, 14, and 21 have been addressed above and rejected for the same reasons, *supra*.

The instant claims differ from Grimbergen and Witek by specifying various nitrogen amount (percent) in the second chemistry (such as claims 1, 3, 5, 7, 8, 15-18). However, a skilled artisan understands that in a plasma etching, the reactive gas content in the etchant gas may be diluted using inert gas in order to obtain slower and more controllable etch rates. Therefore, it would have been obvious to one with ordinary skill in the art to use suitable amount of nitrogen in the process of Grimbergen and

Witek in order to obtain slower and more controllable etch rates and stop the etching process without etching through the silicon dioxide underlayer on the substrate.

As to dependent claims 7 and 13, Grimbergen teaches that the first chemistry includes a selectivity booster (such as He-O₂), see col. 18, lines 22-23.

The above-cited claims differ from the prior art by specifying well-known features (such as SiON hardmask in claim 12) to the art of semiconductor device fabrication. A person having ordinary skill in the art would have found it obvious to modify Grimbergen and Witek by using any of same well-known features to same in order to provide their art recognized advantages and produce an expected result.

It is noted that applicant did not traverse the aforementioned conventionality (e.g., well-known features, obviousness), which have been stated in the office action in Paper No. 16.

Allowable Subject Matter

5. Claims 19 and 20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments


6. Applicant's arguments have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Wang et al. (US 6,232,184; col. 3, lines 35-38) teaches that the inert gas may be used for diluting the etchant.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kin-Chan Chen whose telephone number is (571) 272-1461. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (571) 272-0988.

January 5, 2004


Kin-Chan Chen
Primary Examiner
Art Unit 1765